

Neuroimaging Findings of Common Over the Counter Drug Overdose/ Chronic Misuse

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Financial Disclosures

▶ None

Dextromethorphan

- ▶ **Mechanism:** NMDA receptor antagonist
- ▶ **Therapeutic Use:** Cough suppressant
- ▶ **Overdose:** Clinically can lead to seizures and dystonia.
- ▶ **CT/MR Findings:** Most commonly normal. Rarely can cause focal edema seen on MRI.
- ▶ Of note, Dextromethorphan has neuroprotective effects due to glutamate receptor modulation in therapeutic doses. However, with chronic use or acute overdose, seizures can occur.

Dextromethorphan Imaging

- ▶ **Figure 1:** 65 year old man with chronic cough presenting with seizures. Axial FLAIR image demonstrates increased signal within the mesial left temporal lobe. Differential included Herpes encephalitis or paraneoplastic syndrome. However, the patient had no history of cancer and his viral panel returned negative. The patient endorsed taking dextromethorphan intermittently for over 40 years. Findings were suspected to be related to chronic dextromethorphan use.

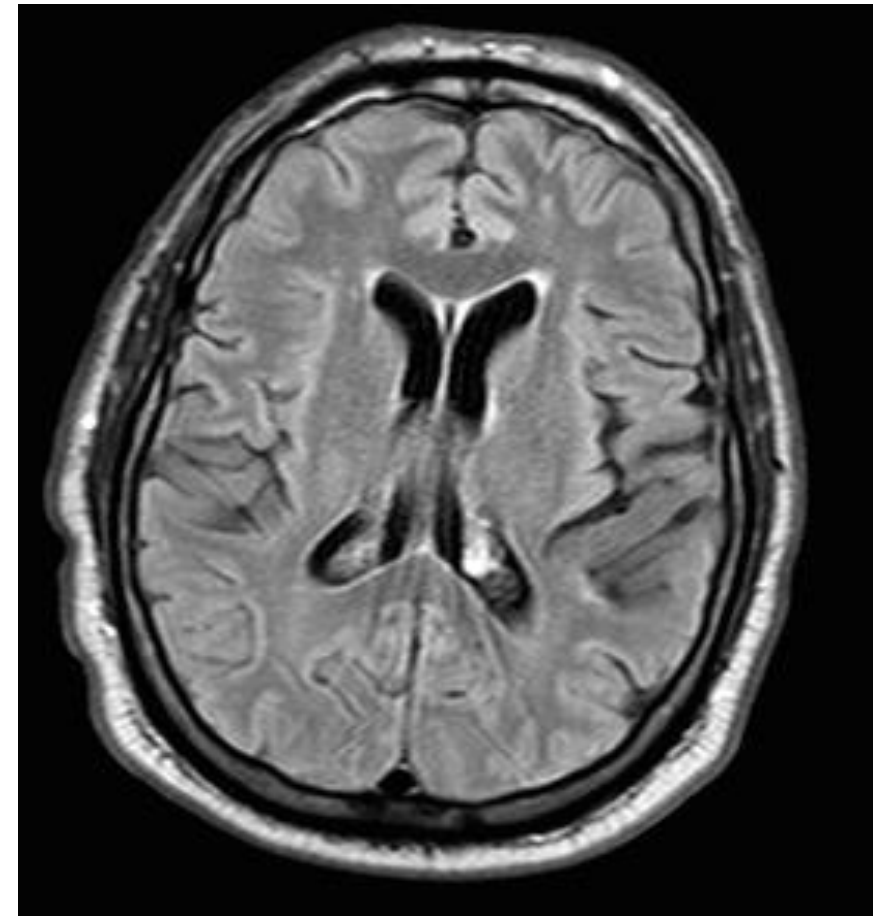


Diphenhydramine

- ▶ **Mechanism:** Histamine 1 receptor antagonist
- ▶ **Therapeutic Use:** Alleviation of sneezing, dry eyes, and itchiness in the setting of allergies.
- ▶ **Overdose:** Rarely can lead to death due to excellent safety profile.
- ▶ **CT/MR Findings:** Most commonly normal. Chronic overuse can lead to dementia, more evident on MRI than CT.

Diphenhydramine Imaging

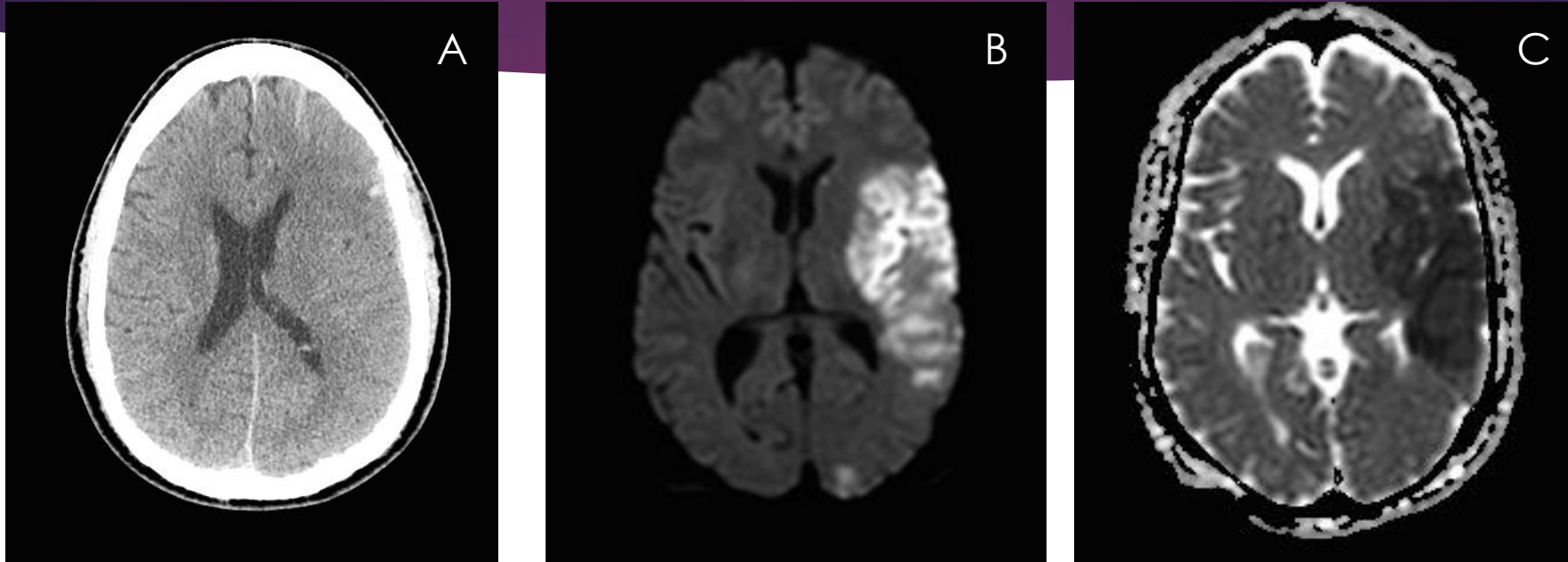
- ▶ **Figure 2:** 52 year old female with chronic seasonal allergies for over 35 years presenting with gradual memory loss, disorientation, and hallucinations. Axial FLAIR image demonstrates prominence of ventricles and sulci slightly disproportionate for age. Given no medical or family history of Alzheimers, diabetes, hypertension, or vasculitides, findings were favored to represent dementia related to chronic diphenhydramine use.



Phenylephrine and Pseudoephedrine (Sympathomimetics)

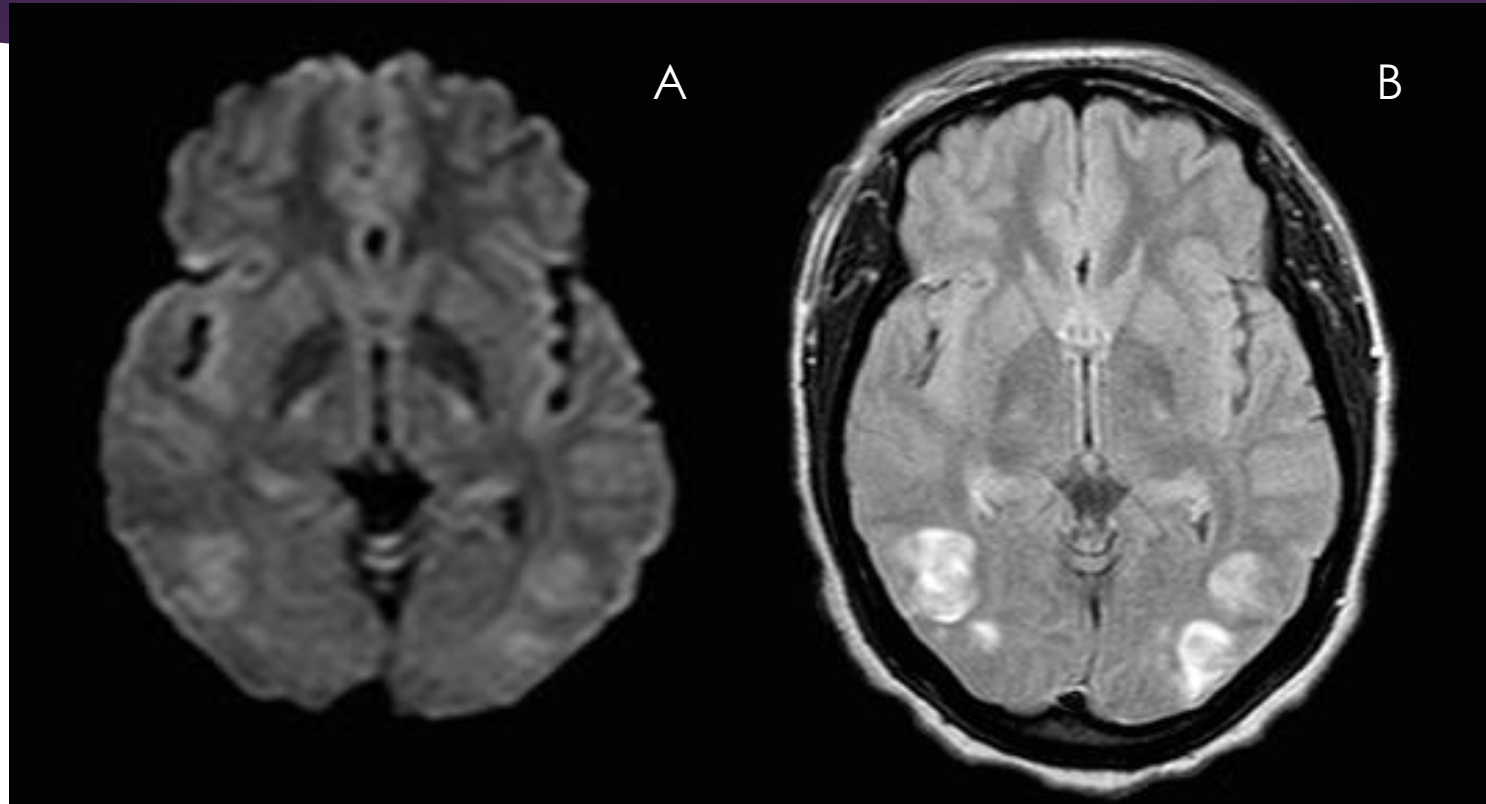
- ▶ **Mechanisms:** Adrenergic receptor agonists
- ▶ **Therapeutic Use:** Alleviations of congestion in the setting of seasonal allergies.
- ▶ **Overdose:** Rare, most commonly causing hypertension, arrhythmias, hallucinations, etc.
- ▶ **CT/MR Findings:** Most commonly normal. Can lead to stroke and reversible vasoconstriction syndrome on both CT and MRI.

Phenylephrine and Pseudoephedrine (Sympathomimetics) - RVCS and Stroke



- ▶ **Figure 3:** 47 year old male with remote history of intermittent cocaine use and chronic year round allergies. A) Axial noncontrast CT image demonstrating subarachnoid and subdural hemorrhage suggestive of reversible vasoconstriction syndrome (RVCS). B-C) DWI and ADC images two days after the CT demonstrates an acute left MCA territorial infarct. These findings were thought to be related to pseudoephedrine overuse.

Phenylephrine and Pseudoephedrine (Sympathomimetics) -PRES



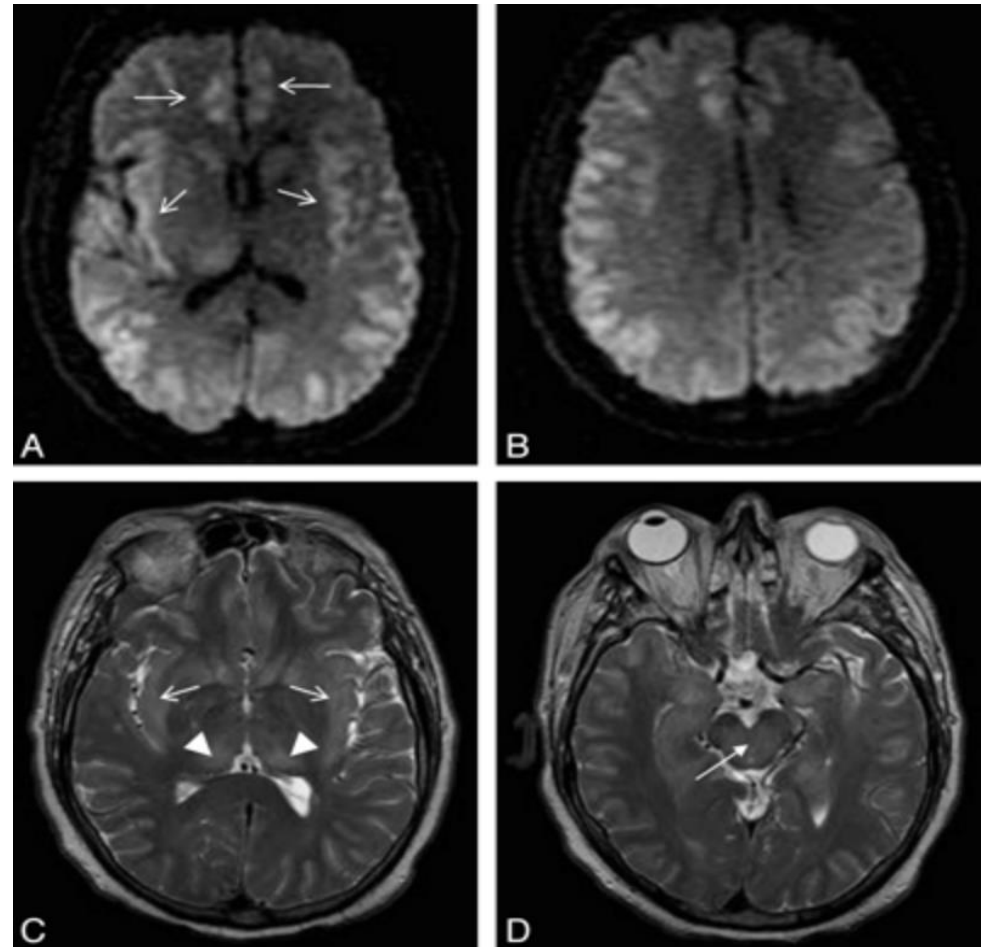
- **Figure 4:** 66 year old male with chronic year round allergies. A) DWI image demonstrating restricted diffusion within the subcortical white matter of the occipitoparietal regions bilaterally. B) Axial FLAIR image shows corresponding high signal within the same areas. Findings were suggestive of posterior reversible encephalopathic syndrome (PRES) in the setting of pseudoephedrine overuse.

Acetaminophen

- ▶ **Mechanism:** Prostaglandin synthesis inhibitor
- ▶ **Therapeutic Use:** Alleviation of pain and antipyretic agent
- ▶ **Overdose:** Rare, most commonly leads to liver and kidney damage.
- ▶ **CT/MR Findings:** Often normal. On MRI, can lead to symmetric restricted diffusion in the cortices, cingulate gyri, and thalami in the setting of encephalopathy.

Acetaminophen Imaging

Figure 5: 48-year-old man with fulminant acute hepatic failure. (A-B) DWI and (C-D) T2WI showing high signal in the insular and cingulate cortices (open arrows), bilateral temporoparietal lobes and thalami (arrowheads), and brain stem (closed arrow). Findings were favored to be secondary to acetaminophen overdose with a background of chronic alcohol abuse causing Acute Hyperammonemic Encephalopathy. The patient's condition worsened eventually dying during his hospital stay.

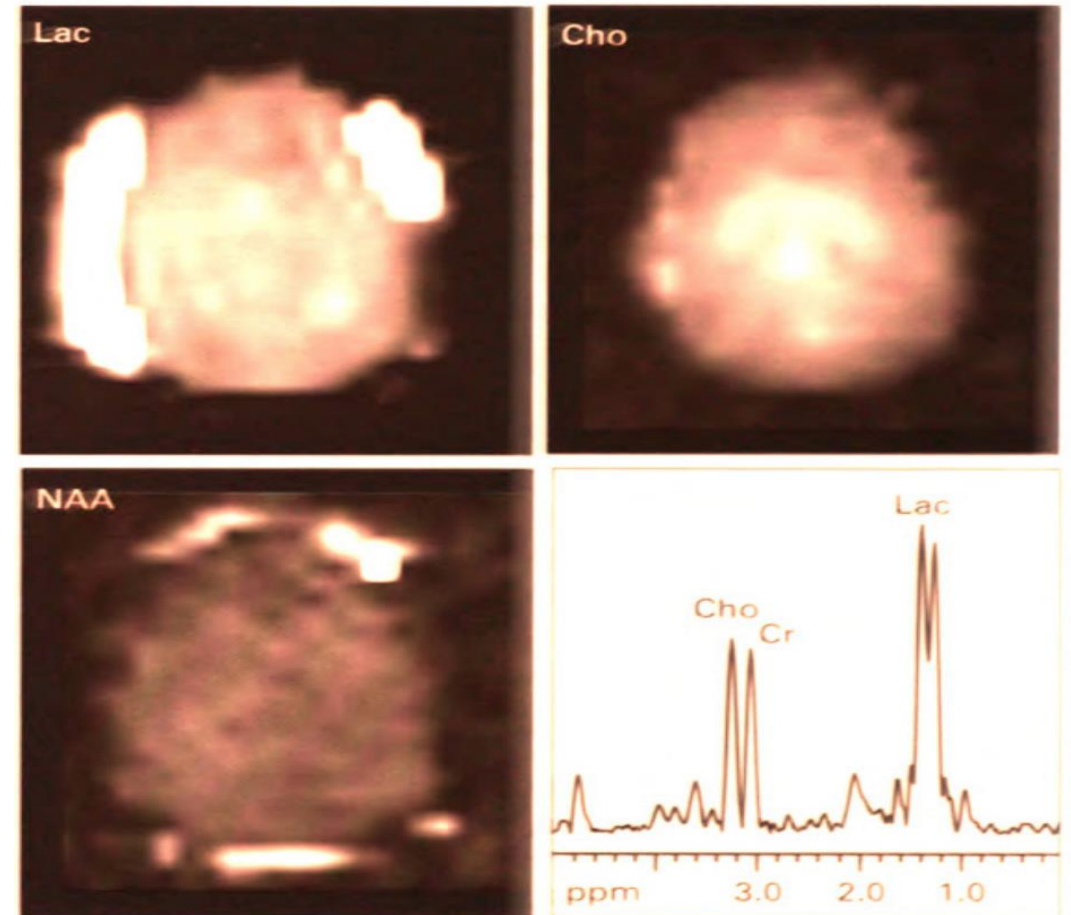


Aspirin

- ▶ **Mechanism:** Irreversible prostaglandin synthesis inhibitor
- ▶ **Therapeutic Use:** Alleviation of pain, prevent clotting, and antipyretic agent
- ▶ **Overdose:** Rare, most commonly leads to kidney damage.
- ▶ **CT/MR Findings:** Often normal. However, can lead to reversible diffuse cerebral edema and high signal in watershed territories.

Reyes Syndrome (Aspirin Overdose) Imaging

- **Figure 6.** MRS demonstrates no discernable NAA levels with elevated lactate peaks. Choline and Cr levels are within normal limits. Findings were compatible with severe ischemic injury.



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